

# **Information Technology and Patient Safety**

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# Iatrogenic Injury

- IOM Report
  - Medical errors kill 44,000-98,000 people a year
  - “More people die from medical errors each year than from suicides, highway accidents, breast cancer, or AIDS”
- Harvard Medical Practice Study, 1984
  - Adverse event rate of 3.7% for inpatients
  - Most common were complications of medication use (19.4%)
  - 71% resulted in a disability lasting less than 6 months, 14% led to death

*Leape, NEJM, 1991*

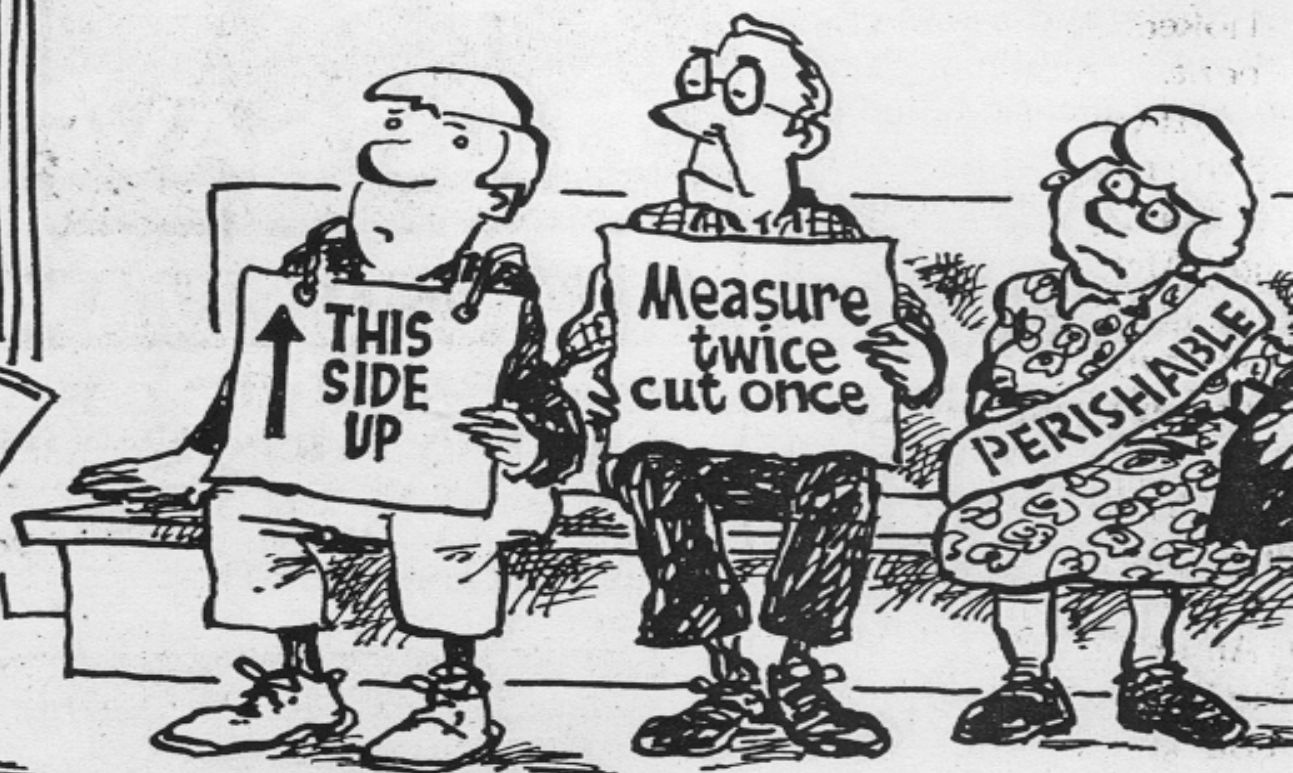
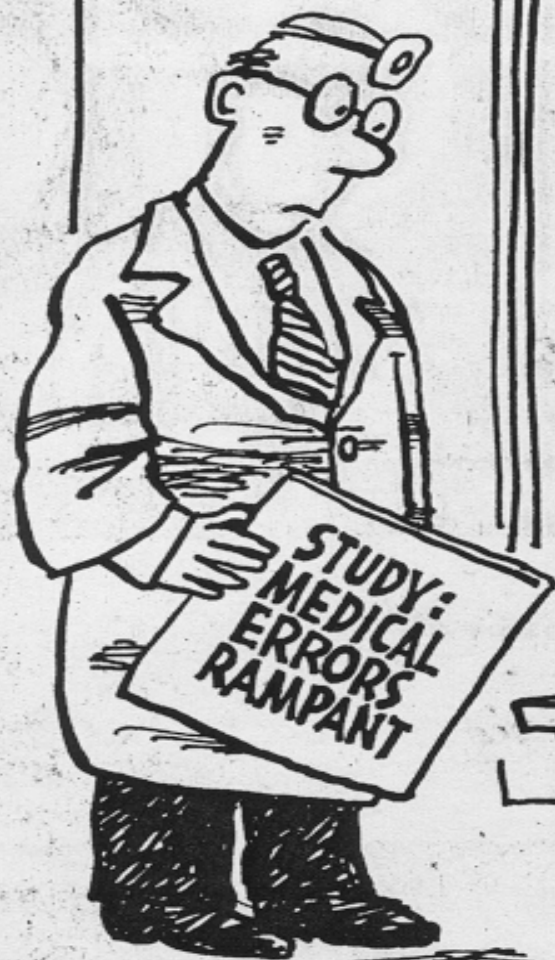
# Inpatient ADEs and Medication Errors, Adults

- Adverse Drug Event (ADE) Prevention Study
  - ADE rate of 6.5 per 100 adult inpatient admits
  - Costly and severe sequelae
  - About a third associated with medication errors

*Bates, JAMA 1995 and 1997*
- Medication errors
  - Rate of 5 per 100 medication orders
  - 7% have potential for harm
  - 1% actually result in an injury

*Bates, JGIM, 1995*

# WAITING ROOM



WASSERMAN  
1999 BOSTON GLOBE  
1ST. BY L.A. TIMES SYND.

# Error Prevention: Information Technologies

- Powerful tool but not a panacea
- Examples include:
  - Computerized physician order entry (CPOE) with clinical decision support
  - Computerized reporting systems
  - Computerized medication administration record
  - Robots
  - “Smart” intravenous devices
  - Automated drug delivery systems
  - Bar coding

# Leadership and IT

Leadership is the capacity to hold a shared vision of that we wish to create.

– Peter Senge

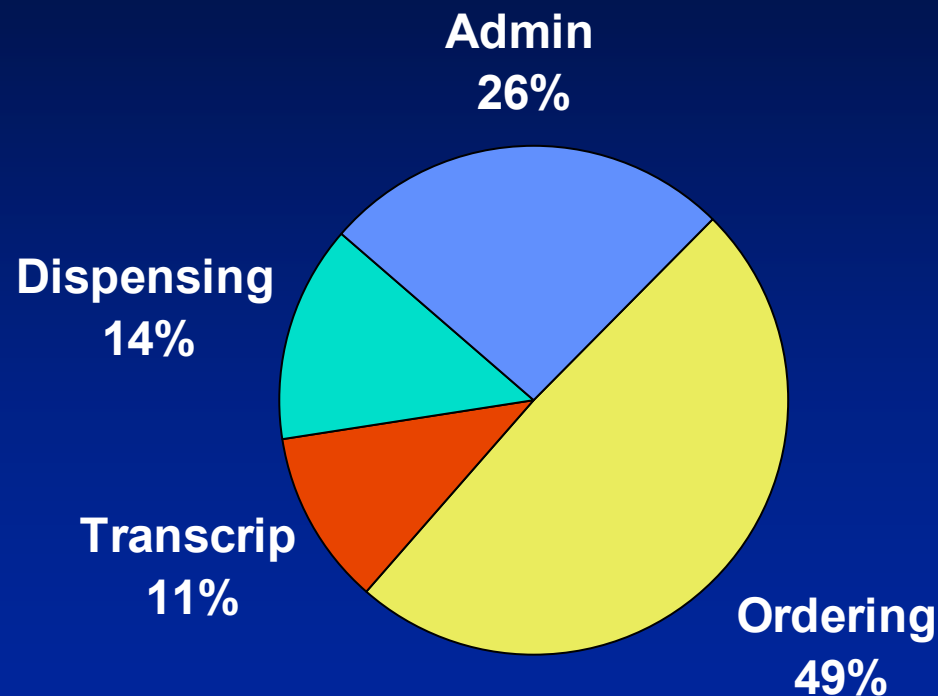
# Overview

- What is CPOE?
- How does it improve the medication use process?
- Measurable effects
  - Medication errors
  - Physician time
  - Physician satisfaction
  - Costs
- Lessons and conclusions

# Computerized Physician Order Entry (CPOE)

- Application that allows physicians to write all orders
  - Most things that happen in hospitals occur as a result of orders
  - Computerizing the ordering process creates structure
  - Allows contact with providers at key times
  - Targets the ordering stage

# Error Stage for Serious Medication Errors



# Why Implement Order Entry?

- Improve quality
  - ADE and med error reduction
  - Prescribing patterns and appropriateness
  - Guideline compliance
- Overall cost reduction (despite initial investment)
  - ADE and med error reduction
  - Laboratory and radiological test reduction
  - Efficiency
- Federal, private, and patient pressures to implement

# Barriers to Order-Entry

- Initial cost
- Provider resistance to automation
- Inconsistency in availability of systems across different areas of practice (e.g. ambulatory setting)
- Tendency for hospitals to computerize business operations over clinical
- Design weaknesses in available systems

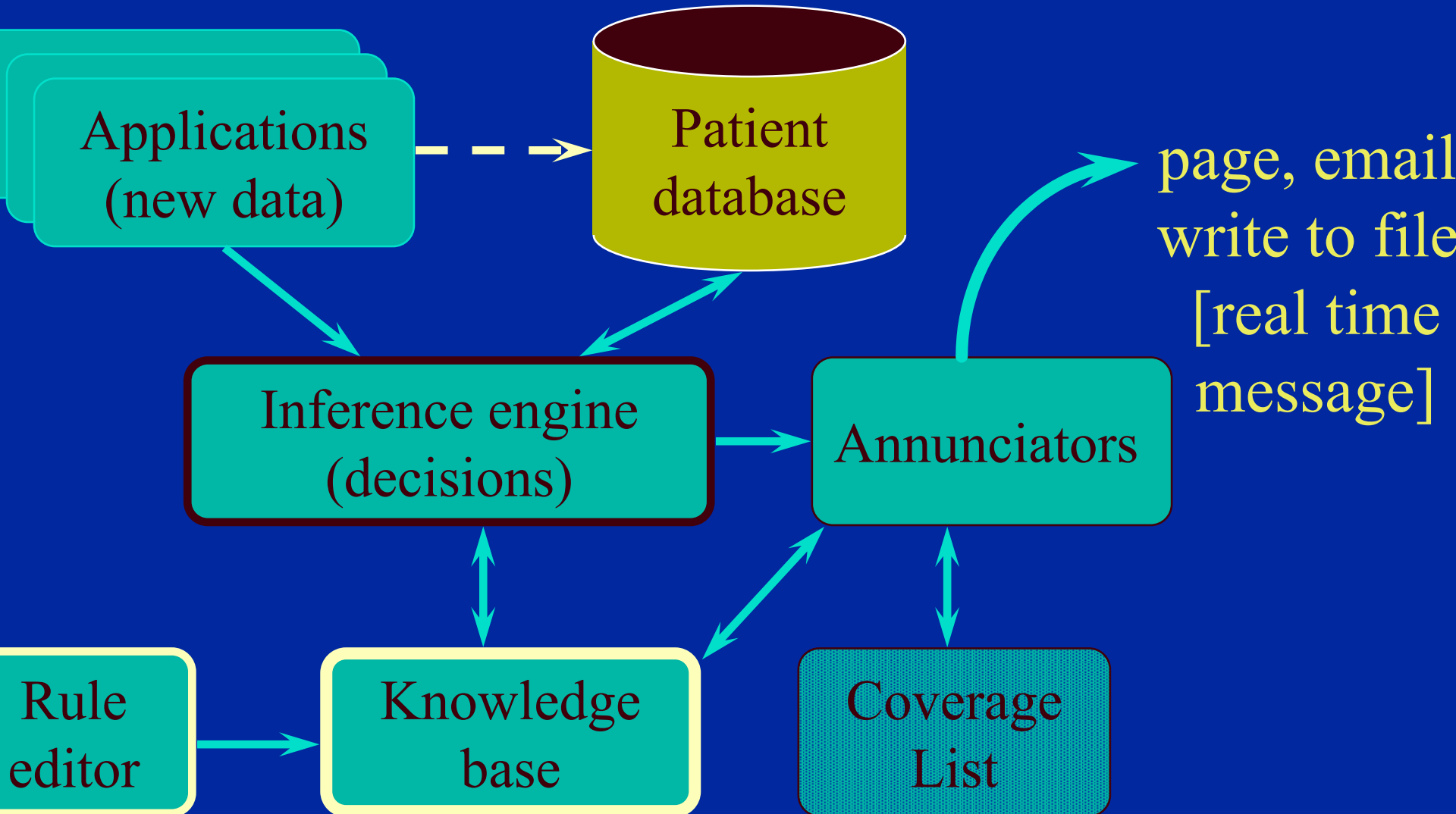
# CPOE with Clinical Decision Support

- Streamlines and structures process
- Performs background checks
- Provides timely information
- Provides feedback about appropriateness of medications, laboratories, and radiological tests
- Provides feedback about costs of medications, laboratories, and radiological tests
- Allows easy implementation of clinical pathways

# Physician Coverage List

- Functions
  - Identifies first and second-call physicians
  - Manages physician rotation
  - Handles evening coverage and signing out
- Facilitates delivery of computer-generated messages
  - Computer-page interface allows automated paging

# Event monitor architecture



## CPOE at BWH

- Implemented in 1993 with physician, pharmacist, nursing and hospital administration support and leadership
- Order entry linked with lab and pharmacy databases
- Decision to automate existing systems
- Constant focus on speed
- Multiple safety features
  - Drug-drug interactions
  - Renal dosing
- Continually adding to and refining the system

# CPOE with Clinical Decision Support

- *Streamlines and structures process*
  - Provides doses from menus
  - Ensures complete orders
  - Ensures legible orders
  - Reduces transcription

# Handwriting example

Aranda 4 May 2012

# Handwriting example

25 u/h

**25 U or 25 cc per hour?**



# Medication Ordering

*(completeness required)*

ViewOrders	PtLookup	Feedback	Help	Goodbye
TEST,TEST 28F 00000000		Adm: 11/01/91 Room:		
MEDICATION ORDER				
(*)New Medication Name [AMPICILLIN]				
(>)ChangeE				
(>)D/C Route [IV_]				
(>)Change Route				
D	Dose:	[		]
F	Frequency:	[		]
T	Start Time:	[		]
U	Duration:	[ ]	< Duration: Total DoSes or dAys or hoUrs >	
P	PRN	[		]
H	Hold if:	[		]
I	Instructions:			
ALLERGIES: PENICILLINS,				
			< Hold >	Loading Dose
Ok			Cancel	
Enter all or part of the route (PO, NG, IV, etc).				

# Listed Doses

BICS #1

8 x 12

ViewOrders PtLookup Feedback Help Goodbye

JTTEST, JON 36F 11111111 Adm: 11/01/91 Room: 17A-117

(<\*)New Medication Name DOSE: DIGOXIN PO

Rout

< dose List >

D Dose: [ ]  
F Frequency: [ ]  
T Start Time: [ TODAY ]  
U Duration: [ ] Days  
P PRN [ ]  
H Hold if: [ ]  
I Instructions: [ ]

ALLERGIES: CEPHALOSPORINS, COUM  
-----RECENT LABS-----  
DIG: ---  
K: 3.1\*# 04/02/96

Move to desired choice with mo

ALTERNATE DAYS  
VARIABLE  
0.0625 MG  
0.125 MG  
0.25 MG  
0.375 MG  
0.5 MG  
OTHER

Ok Cancel

# CPOE with Clinical Decision Support

- *Performs background checks*
  - Drug-allergy
  - Dose ceiling
  - Drug-patient characteristics
  - Drug-laboratory
  - Drug-drug

# Dose List Adjustment for Renal Function

BICS #1

8 x 12

ViewOrders PtLookup Feedback Help Goodbye

OETEST,MCGEORGE 51M 11489952 Adm: 11/01/91 Room: 17A-112

<\*)New Medication Name DOSE: DIGOXIN PO

Route List adjusted for renal function <Show data>

< dose List>

ALTERNATE DAYS  
VARIABLE  
0.0625 MG  
0.125 MG  
OTHER

D Dose: [ ]  
F Frequency: [ ]  
T Start Time: [TODAY]  
U Duration: [ ] Days  
P PRN [ ]  
H Hold if: [ ]  
I Instructions: [ ]

ALLERGIES: PENICILLINS, TYLENOL  
-----RECENT LABS-----  
DIG: ---  
K: 3.1 08/09/97

Move to desired choice with mo

Ok Cancel

# Drug-Allergy Interaction Warning

<b>ViewOrders</b>	<b>PtLookup</b>	<b>Feedback</b>	<b>Help</b>	<b>Goodbye</b>
TEST,TEST 28F 00000000		Adm: 11/01/91 Room:		
<b>DRUG WARNING(S) FOUND</b>				
<b>Current Order:</b> AMPICILLIN IV				
<b>Warnings:</b>				
DEFINITE ALLERGY				
<b>Message:</b>				
Pt. has a DEFINITE allergy to PENICILLINS. (Documented allergy to PENICILLINS --> anaphylaxis.)				
<b>(*)C Cancel order</b> <b>( )K Keep (override) order</b>			<b>Ok</b>	
Use up & down arrow keys to read warning messages.				

# Drug-Drug Interaction Checking

Mumps

View PtLookup

Patient: C[ ] R[ ] 29F 07535[ ]  
Time: 02/03/95 04:52 PM Alert#82343  
Alert: PATIENT ON FLUOXETINE & MAO INHIBITORS -- POTENTIALLY FATAL; DISCONTI  
Reason: Patient is currently on FLUOXETINE HCL.  
Patient is currently on PROCARBAZINE.

Relevant medications: Alert Details

Act-ions: A Exit directly to Order Entry

Covering M.D.: Bp#  
done <done, Go to OE> comments Page M.D.  
Logic

Press ALT-O or ALT-G to exit and acknowledge alert.

# CPOE with Clinical Decision Support

- *Provides timely information*
  - Reduces reliance on memory and vigilance
  - Guided dose algorithms
  - Provides default route and frequency

## **Example: Impact of CPOE on Chemotherapy Safety**

- Handles order sets and protocols well
- Allows dose checking
  - Daily, weekly, and lifetime
- Performs calculations
- Performs background lab checks
- Allows enforcement of tiered restrictions on physician ordering
- Remembers individual medication history

# Chemotherapy Order: Patient Characteristics

BICS

ViewOrders PtLookup Feedback Help Goodbye

TEST,TEST 34F 00000000 Adm: 11/01/91 Room:

### Chemotherapy Order Profile

Currently ordering: ADRIAMYCIN (DOXORUBICIN) IU

X Primary Diagnosis: [meitis ]

I Indication for Chemotherapy: [same ]  
(if diff. from primary dx)

P Research Protocol Name & No.: [7655676 ]

H Heig

C Heig

L Weig

W Weig

Calc

B Dosi

R Rout

Patient's height is 66 inches. (167.6 cm)  
Patient's weight is 178.2 pounds. (81.8 kg)  
Patient's BSA is 1.91  
Is this correct?

< Ok >

Type the letter of the field you wish to change.  
Press Enter or Alt-0 to accept. Esc to cancel.

# High Chemotherapy Dose: Requires Attending Physician's Approval

BICS

ViewOrders PtLookup Feedback Help Goodbye

TEST,TEST 34F 00000000 Adm: 11/01/91 Room:

Chemotherapy Medication Parameters

Med

Specify Attending Physician

Physician name  
[David Bates, M.D.]

Enter the name of the physician who originated this order. Last,First or clinical ID

No entries found

Type the letter of the field you wish to change.  
Press Enter or Alt-0 to accept. Esc to cancel.

gh chemotherapy doses.  
oved.  
e orders  
r cancel orders  
ancel

# High Chemotherapy Dose Warning

BICS

ViewOrders PtLookup Feedback Help Goodbye

TEST,TEST 34F 00000000 Adm: 11/01/91 Room:

Chemotherapy Medication Parameters

Medication/Route ADRIAMYCIN (DOXORUBICIN) IVB

**WARNING -- HIGH CHEMOTHERAPY DOSE**

39mg/m<sup>2</sup> Q4H exceeds the daily maximum dose limit of  
60mg/m<sup>2</sup> for DOXORUBICIN  
Are you sure about this order?

<No, return to template to change dose. >

<Yes, Continue order with current dose. >

ended by Pharmacy

# CPOE with Clinical Decision Support

- *Provides feedback about appropriateness of medications, laboratories, and radiological tests*

# Medication Appropriateness

- Vancomycin intervention important due to VREF
- Provided reminders about appropriate use at time of initial ordering or renewing of drug
- Vancomycin use was reduced
  - Vancomycin-days/prescriber 37% lower
  - Duration of therapy 17% lower

*Shojania, JAMIA 1998*

# “Panic” Laboratory Study

- For markedly abnormal results (K, Na, glucose, Hct)
  - Allows consideration of other factors
  - Direct interface with paging system
- “Before” data
  - Median time to rx 2.5 hours
  - For 25% > 5.3 hours
- RCT results
  - Mean time to rx 11% shorter ( $p < .0003$ )
  - Mean time to resolution 29% shorter ( $p = .11$ )
- 95% physicians pleased to be paged

Kuperman, *JAMIA* 1999

# Chest Radiographs and Structured Ordering

Percent Acceptable

History

Assess/R/O

Before

78%

35%

After

99%

99%

# Low Yield Critique

BICS

ViewOrders PtLookup Feedback Help Goodbye

TEST,TEST 35F 00000000 Adm: 11/01/91 Room:

KUBU Indications

Relevant His

[ ] A Nausea & V  
[1] B Non-specific  
[ ] C H/O Bowel  
[ ] D Feeding Tu  
[ ] O Other [

R/O or Asses

[ ] L Bowel Obst  
[1] M Perforated  
Viscous/  
[ ] N Constipati  
or Fecal  
[ ] W Other [

clin. History:

Ok Cancel

Comment on Indications

Please consider the following:

If a patient has non-specific abdominal pain, a KUB is of very low yield. Studies show at most a 2% incidence of helpful findings for this indication. (Ann Emerg Med, 1982, McCook et al, 11:7-8, Ann Int Med, 1982, Eisenberg et al, 257-261).

Of all studies done at this hospital in a recent two month period for non-specific abdominal pain, NONE demonstrated a positive finding.

Direct comments to David Bates, M.D. x7063

Cancel order Continue with order Display info

Type a letter or number. Choose at least 1 Relevant History and 1 Assessment.  
Enter or Alt-0 : done. Alt-H : additional clinical history.

# Alternate Exam

BICS

ViewOrders PtLookup Feedback Help Goodbye

TEST,TEST 35F 00000000 Adm: 11/01/91 Room:

KUBU Indications

Relevant History (please enter primary reason first):

[1] -- Suggest Alternative Exams

If you suspect perforated viscous/free air, then a chest PA view and KUB (supine) films are recommended. If the patient is unable to stand, then a lateral decubitus of the abdomen and KUB (supine) films are recommended.

[1] Direct comments to David Bates, M.D. x7063

☐ Chest & kub ☐ Lateral abdomen & kub

Ok Cancel

Type a letter or number. Choose at least 1 Relevant History and 1 Assessment.  
Enter or Alt-0 : done. Alt-H : additional clinical history.

# CPOE with Clinical Decision Support

- *Provides feedback about costs of medications, laboratories, and radiological tests*

# Reducing Drug Costs with Order Entry

- Types of useful suggestions
  - Drug interchange
  - Lower dose
  - Different route (IV-PO switches)
  - Guidelines for use

# More Efficient Use of Medications

BICS

ViewOrders PtLookup Feedback Help Goodbye

TEST,TEST 34F 00000000 Adm: 11/01/91 Room:

MEDICATION ORDER

(\*)New Medication Name [CEFTRIAXONE]

What is the indication for CEFTRIAXONE use:

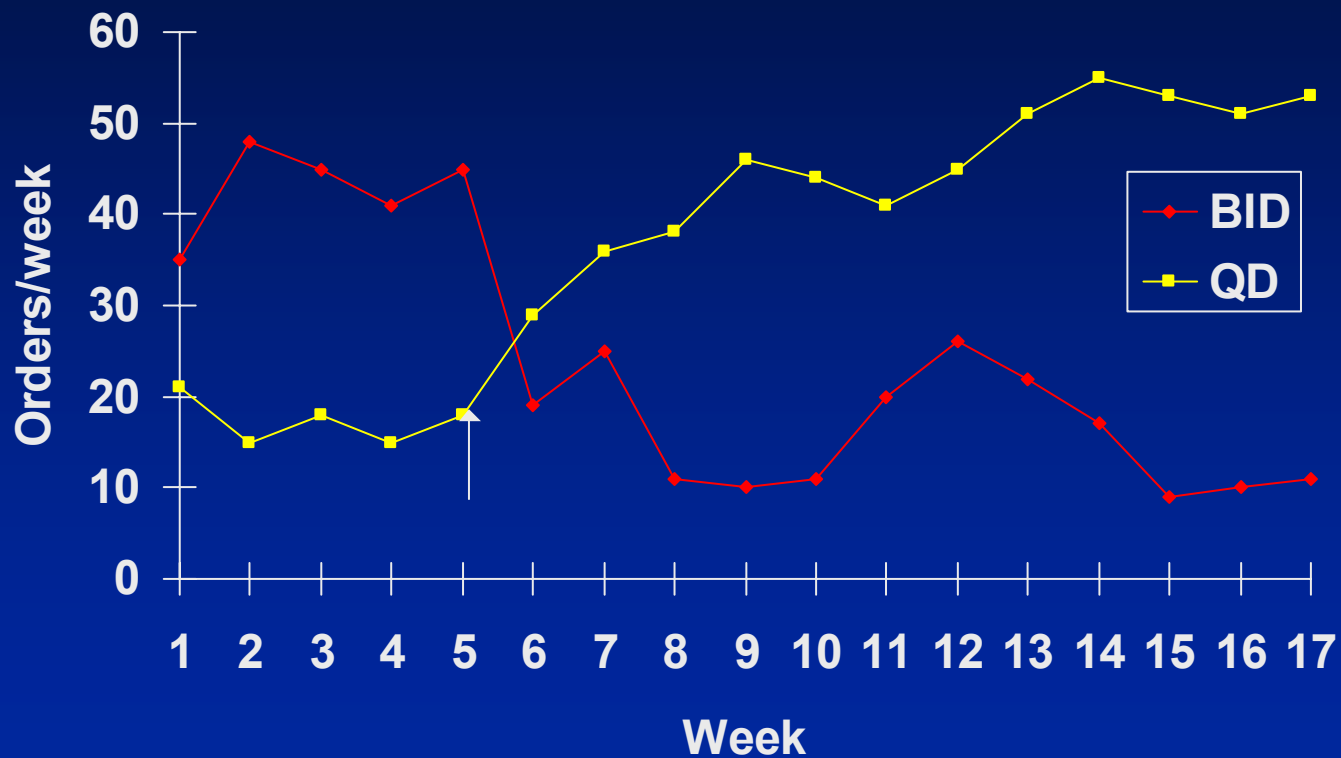
A	[X]	Community-acquired pneumonia
B	[ ]	Urinary tract infection
C	[ ]	Fever in a neutropenic patient
D	[ ]	Suspected or confirmed bacterial meningitis
E	[ ]	Suspected septic shock
F	[ ]	Nosocomial pneumonia
G	[ ]	IM treatment of gonococcal disease
H	[ ]	Single IV dose for patient being discharged
I		other [ ]

< Ok > [Cancel]

Ok Cancel

Enter all or part of the route (PO, NG, IV, etc).

# Effect of Changing Default Dosing Frequency for Ceftriaxone



# Guideline for an Expensive Agent

Mumps		
ViewOrders	PtLookup	Feedback Help Goodbye
TEST,TEST	34F 00000000	Adm: 11/01/91 Room:
<b>P&amp;T NOTICE - HUMAN GROWTH HORMONE</b>		
The use of human growth hormone (\$175 per dose) has been approved only for the patient who is receiving adequate nutrition, has adequate arterial oxygenation (SaO <sub>2</sub> >90%), and has:		
<input type="checkbox"/> A major burns, documented impaired healing over 10 days, age>60; OR		
<input type="checkbox"/> B major burns, documented impaired healing over 10 days, and debilitating underlying condition (e.g., renal failure); OR		
<input type="checkbox"/> C burns >80% total body surface, who requires rapid healing of donor sites to improve survival; OR		
<input type="checkbox"/> D large traumatic wound(s), documented impaired healing over 10 days.		
<b>Please indicate the applicable reason.</b>		
Requests concerning exceptions to these guidelines must be made in writing by the attending physician to the chairman of the Pharmacy and Therapeutics Committee, Dr. Jamie Maguire.		
Continue Current Order		Cancel Order

# Charge Display

ViewOrders	PtLookup	Feedback	Help	Goodbye
TEST,TEST	28F 00000000	Adm: 11/01/91 Room:		
COMMON LAB ORDERS				
\$23 [ JA CBC	\$17 [ JH BUN	\$25 [ JR Amylase		
\$36 [ JB DIFF	\$17 [ LJ Creatinine	\$25 [ JS Lipase		
\$33 [ JC PT	\$17 [ JK K+	\$19 [ JU Bilirubin		
\$33 [ JD PTT	\$17 [ JL Glucose	\$23 [ JV HCT		
\$17 [ JE U/A + Sed	\$90 [ JM Blood Gas	\$39 [ JW Urine C+S		
\$52 [ JF Profile 20	\$17 [ JN Magnesium	\$104 [ JX Type+Hold		
\$34 [ JG Profile 7	\$17 [ JP Calcium	\$104 [ JY BC x 2		
	\$130 [ JQ CK + MB	\$17 [ JZ F'stick Glu		
<NEXT TEST STAT> NO				
0 Other Lab Test Names (separated by commas)				
[				
I Collection Time: NEXT AVAILABLE				
I Instructions:				
<_ Ok > <Cancel> <Multi-day labs> <D/C-Change> <Microbiology>				
Type the letter of test you wish to order. Type the letter again to deselect. Press Alt + red letter of the desired operation. Alt-0: accept. Esc:cancel				

# CPOE with Clinical Decision Support

- *Allows easy implementation of clinical pathways*

# Order Entry and Critical Paths

- Critical paths specify what should happen for a specific day
  - Essentially sequences of order sets
  - In place for 25 diagnoses
- Have decreased LOS, costs, improved satisfaction
- Require physicians to select diagnosis at admission
  - Allows prompting about path
  - Increases likelihood path will be selected

# A Study of CPOE and Medication Error Prevention

- Medication errors as main outcome
- Design: interrupted time series analysis over 5 years
- Intervention: POE at several stages of development
- Units studied: three medical units

*Bates, JAMIA 1999*

# System Characteristics By Period

## Baseline

- Hand written orders
- No automated decision support

# System Characteristics By Period

## Period 1

- Basic CPOE
- Minimal clinical decision support
  - Relevant laboratories displayed
  - Several drug-lab checks
  - Rudimentary drug-allergy checking
  - Redundant medication checking
  - Rudimentary drug-drug interaction checking
- Many orders entered using pre-approved order sets

# Systems Characteristics By Period

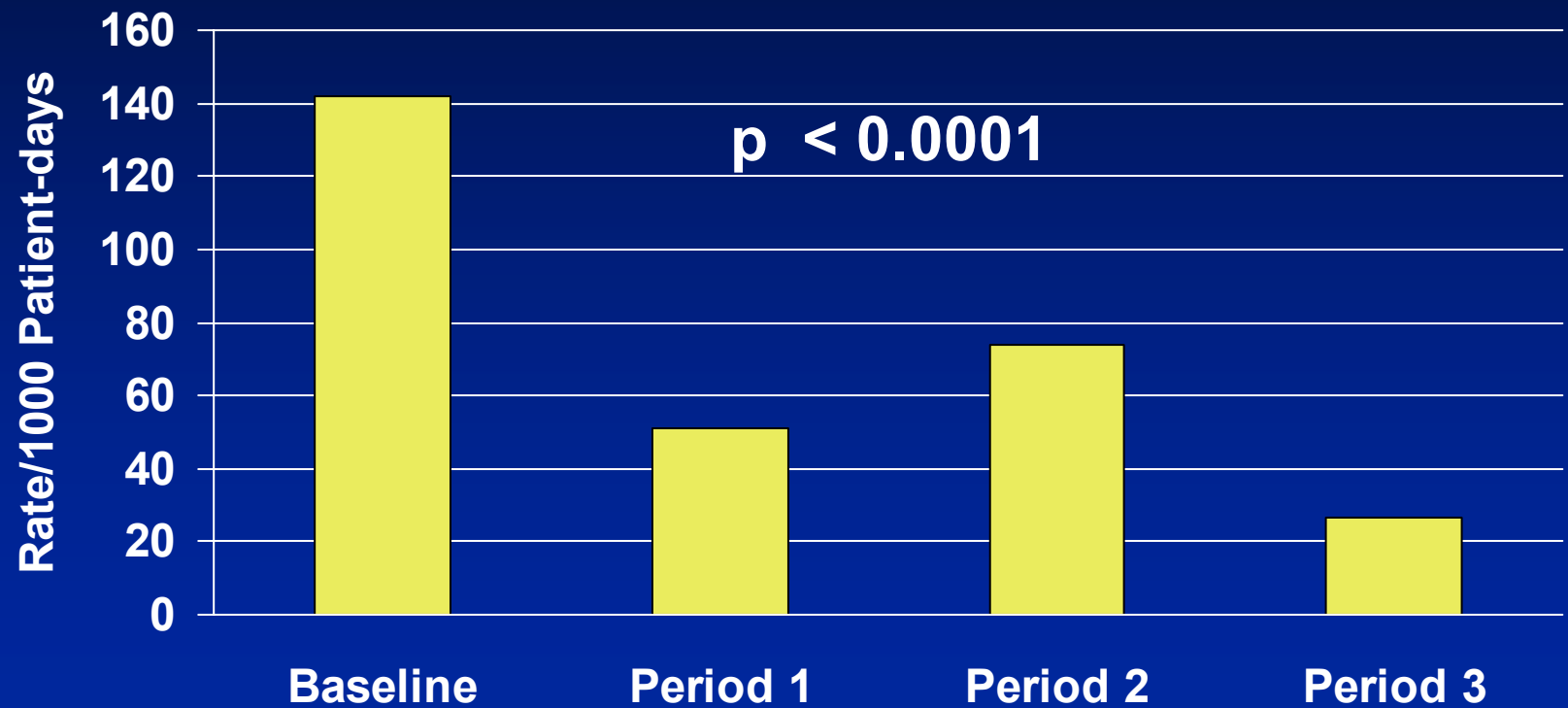
## Period 2

- Improved drug allergy checking

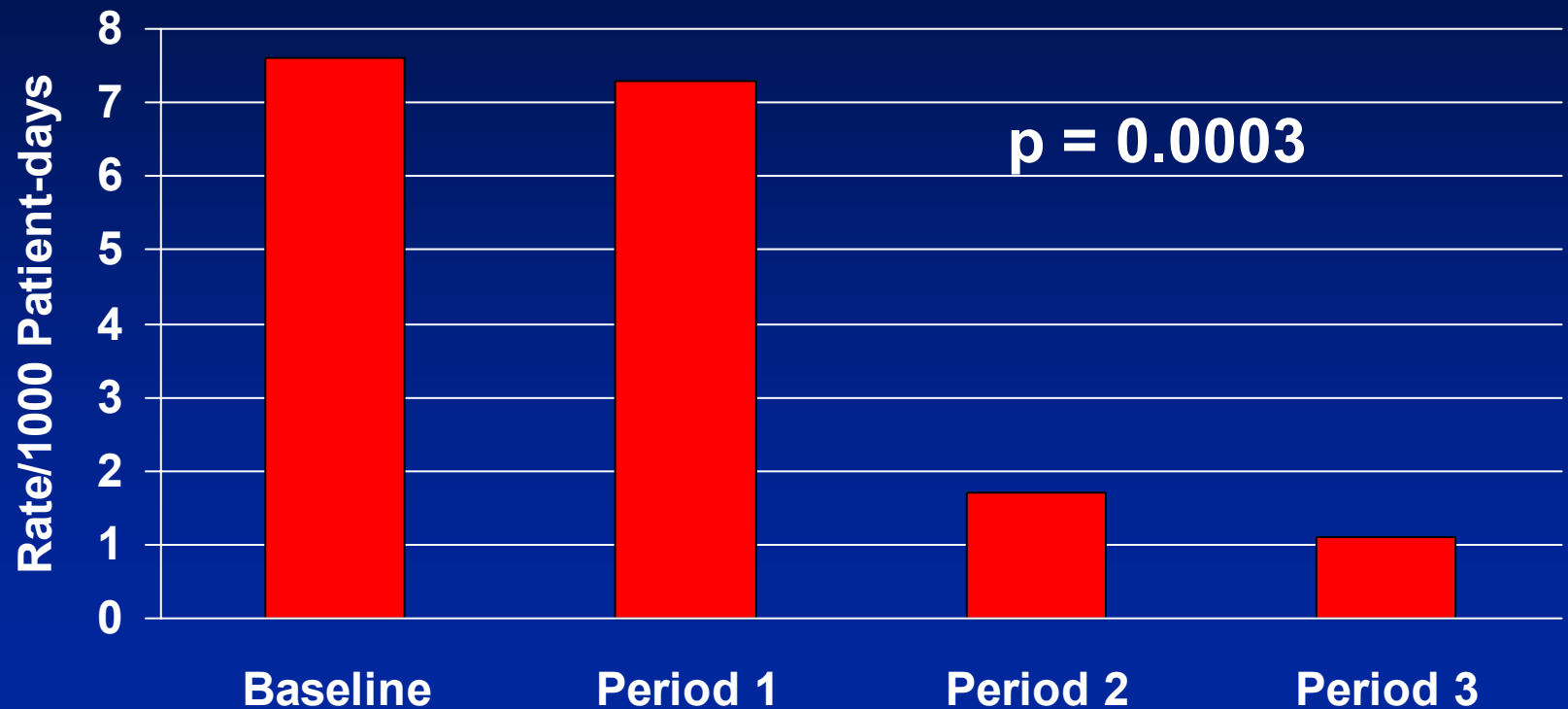
## Period 3

- Improved potassium ordering
- Improved drug-drug interaction checking

# Effect of POE on the Medication Error Rate



# Effect of POE on the Serious Medication Error Rate



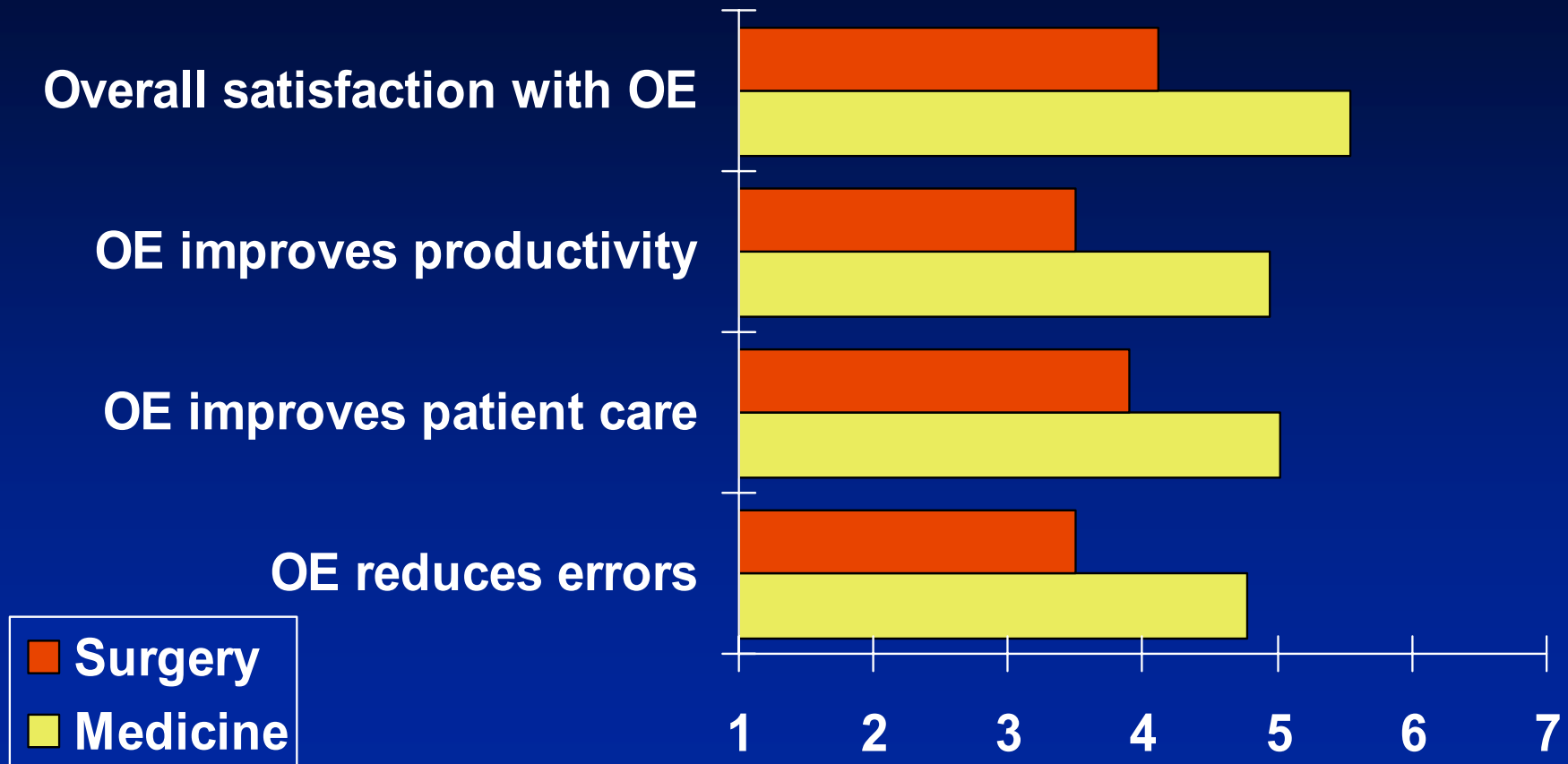
# Study Conclusions

- Medication error rate fell 81%
- Serious medication error rate fell 86%
- Three quarters of reduction in medication error rate was achieved with a relatively simple system
- Reductions were found across many error types and in both general care units and ICUs

# Impact of CPOE on Physician Time

- Order writing took twice as long on computer
  - Medical HOs 44 min/day, recovered half
  - Surgical HOs 73 min/day, no recovery
- Daily and one-time orders accounted for most of change, increasing 3-fold
- Sets of orders took half the time they did before order entry
- Interventions
  - Introduction of “Write 1”
  - Reorganization of screens to facilitate access to CPOE

# HO Satisfaction with OE



Lee, JAMIA 1996

1=never, 7=always

# Inpatient Costs of ADEs

- ADEs are expensive
  - \$2400 per ADE
  - \$4500 per preventable ADE
- Annual BWH costs estimated for 1997
  - \$5.6 million for all ADEs
  - \$2.8 million for preventable ADEs
- These figures exclude costs of:
  - Long term injuries to patients and malpractice suits

*Bates, JAMA 1997*

- Total annual U.S. costs estimated to be \$76.6 billion

*Johnson and Bootman*

# How Many ADEs Do You Have and What Do They Cost?

Beds	ADEs	Costs	Prev ADEs	Costs
700	1900	4,680,000	530	2,410,000
400	1086	2,670,000	304	1,380,000
200	543	1,340,000	152	690,000
100	272	670,000	76	350,000

# Rough Cost-Benefit for POE

- Costs:

- Development \$1,000,000
- Hardware \$400,000
- Maintenance \$500,000/year

- Benefits:

- Overall \$5-10 million/year charges
- Main savings relate to efficiencies (re. drugs and tests) and ADE prevention

# Lessons To Date

- Physicians are happy to change direction
  - Much less willing to stop after action started
- Respond well to quality-related suggestions
- Even simple interventions have high yield--and most likely to be accepted
- Satisfaction with these efforts good
- Integration with practice flow key
- Developers must think speed, speed, speed...

# Surprises

- Groups of orders were even more important than expected, best regulated by departments
- Individual order sets weren't important and caused many problems
- Free text ordering was also problematic
- Key not to allow types of orders to bypass logic
- Important to have follow-up of major over-rides
- On-going support requires a lot of attention

# What Do Providers Want From IT?

- Speed
- Ability to access information from multiple sites
- Different views of same information
- Ability to aggregate across patients
- Better information about performance
- Decision support that anticipates needs and doesn't waste time

# What Can IT Do To Help?

- Can improve communication between:
  - Providers
  - Payors/providers
  - Patients/providers
- Can decrease costs, improve quality, by
  - Pointing out redundancies
  - Suggesting alternatives
  - Identifying errors of omission
  - Emphasizing important abnormalities
  - Making guidelines accessible
- Make routine quality measurement possible

# Conclusions

- Environment demands value
  - Need to reduce costs
- Electronic records vital for providing integrated, inexpensive, high-quality care
- Decision support delivered using IT will be key tool for achieving this
  - Should be evidence-based
  - Will require manual help for education, followup
- Most future quality measurement will be done by computer as a part of routine care
  - Possible to measure outcomes routinely

# Inpatient Medication System of the Future

- Providers write orders on computerized systems, get feedback
- Orders electronically sent to pharmacy
  - Computerized pharmacy system and pharmacist review
- Simple orders filled using automation
  - Pharmacy fills complex orders manually
- Point-of-care delivery devices linked with order-entry systems dispense medications
  - Intravenous medications delivered by “smart” systems
- All drugs, patients, personnel bar-coded
  - Computerized MAR records what given and when

# ADEs In Outpatients

- 75% of office visits to PCPs associated with initiation or continuation of a drug
- Much less well studied
- Preliminary results of one study
  - Prescription screening (n=1173)
    - 4% medication errors and 5% potential ADEs
  - Patient survey at 2 weeks (n=661)
    - 27% reported an ADE
      - 36% of these were preventable (2/3 due to MD, 1/3 due to patient)

# Outpatient Prevention

- Computerizing prescribing highest yield
  - Allergy detection
  - Notification about drug-drug interactions
  - Dose suggestions
- Paper prescribing is archaic
  - Electronic medical records
  - New handheld devices
- ISMP has called for eliminating handwritten prescriptions by year 2003

# Outpatient order entry systems

- Most patients receive medications in the outpatient setting
- Significant cost and quality issues around outpatient ADEs and medication use
- Electronic medical records with computerized prescribing have potential for great benefit
- Recently implemented at BWH

# Summary screen

Clinical Application Suite Tuesday Apr 11, 2000 You are logged in as: Gilad J. Kuperman, M.D.

Select pt **CLAUS, SANTA C** **MGH - 0000004** 90y M ZIETMAN, ANTHONY L  
INS/INSURED SELF-PAY [Pt Details](#)

[Flowsheet](#) [Health Maint](#) [History](#) [Notes](#) [To Do](#)

**Summary1** [Summary2](#) [Medications](#) [Probs/Procs](#) [Allergies](#)

Orders

LMR

Results

List Mgmt

Help

Feedback

Exit

CAS 4.2.15

DeskTop Patient Chart Reports Custom Sign F10

INT MED - NEVILLE HOUSE

CLAUS, SANTA 0000004

5:23 PM

**problems**

Remembering things  
Angioplasty  
H/O multiple sclerosis  
OM  
Memory problems Minor  
H/O chf  
Psoriasis  
Ulcerative colitis  
musculoskeletal hernia

**medications**

BENADRYL (DIPHENHYDRAMINE)	25-50	Q6H
VIT B1 (THIAMINE HCL)	Alter...	
PROZAC (FLUOXETINE HCL)	20	QD
VIOXX (ROFECOXIB)	12.5	QD
COPAXONE (GLATIRAMER)	20	QD
AMOX./CLAV.ACID 250/125	250	TID
MYLANTA II	15	Q4H
RITALIN (METHYLPHENIDATE ...)	30	BID
BEZILIN (TROGLITAZONE)	200	QD

Pharmacy: CVS/PHARMACY BOSTON PHARMACY

**procedures**

Cardiac catheterization  
Head trauma

**allergies**

Strawberries	Rash
Nuts	Anaphylaxis
BENADRYL (DIPHEN...)	Hypotension
Morphine	Mental Status Change
A.C.E INHIBITORS	Anaphylaxis
Penicillins	Mental Status Change

**sticky note**

next time check immunization dates  
weigh patient-next visit

# Enter a medication

Clinical Application Suite Tuesday Apr 11, 2000 You are logged in as: Gilad J. Kuperman, M.D.

Select pt **CLAUS, SANTA C** **MGH - 0000004** 90y M ZIETMAN, ANTHONY L Pt Details  
INS/INSURED SELF-PAY

Flowsheet Health Majnt History Notes To Do  
Summary1 Summary2 Medications Probs/Procs Allergies

Orders  
LMR  
Results  
List Mgmt

Medications	Rx	Dose	Freq	Ro...	Qty	Dur	Ref	Start	Stop
ERYTHROMYCIN		500 MG	QID	PO			0	4/5/00	
COUMADIN (WARFARIN SODI...	Rx	1 MG	QD	PO	20 ...	30	4	04/01/2000	
LANOXIN (DIGOXIN)		0.25 MG	QD	PO	488		3	03/08/00	

ALLERGIES: Demerol, Penicillins, A.C.E INHIBITORS, Morphine, BENADRYL (DIPHENHYDRAMINE HCL), Nuts, Strawberries

Med: **CODEINE PHOSPHATE** Route: **PO** Search

Dose: **30 MG**

Frequency: **Q4H** for a duration of  day(s)

Dispense:

Refills:

☐ PRN:  
☐ No Substitutes  
☐ Patient Educated  
☐ Prescription

Comments: This will not print on prescription

☒ Don't Expire Start Date: **4/11/00** End Date:  Ok Cancel

Add To Favorites

CAS 4.2.15 DeskTop Patient Chart Reports Custom Sign F10 INT MED - NEVILLE HOUSE  
CLAUS,SANTA 0000004

Start Clinical Application Suite ... 5:24 PM

# Drug allergy

Clinical Application Suite Tuesday Apr 11, 2000 You are logged in as: Gilad J. Kuperman, M.D.

Select pt **CLAUS, SANTA C** MGH - 0000004 90y M ZIETMAN, ANTHONY L  
INS/INSURED SELF-PAY Pt Details

Flowsheet Health Maint History Notes To Do  
Summary1 Summary2 Medications Probs/Procs Allergies

Medications	Rx	Dose	Freq	Ro...	Qty	Dur	Ref	Start	Stop
ERYTHROMYCIN		500 MG	QID	PO			0	4/5/00	
COUMADIN (WARFARIN S								4/01/2000	

ALLERGIES: Demerol, Penicillin

Med: **PENICILLIN V POTASSIUM**

Dose:

Frequency:

Dispense:

Refills:

☐ PRN:

☐ No Substitutes

☐ Patient Educated

☐ Prescription

☒ Don't Expire Start Date: T 4/11/00 End Date: T

Comments: This will not print on prescription

**Drug Allergy/Sensitivity Warning**

You are ordering PENICILLIN V POTASSIUM.  
The patient has a documented allergy to Penicillins  
(reaction: Mental Status Change)

INT MED - NEVILLE HOUSE  
CLAUS, SANTA 0000004

CAS 4.2.15 DeskTop Patient Chart Reports Custom Sign F10 Start Clinical Application Suite ... 5:25 PM

# Preliminary Studies

- Sites with basic computerized prescribing have a significantly lower rate of medication errors
- Further studies
  - Impact on serious medication errors
  - Cost-benefits

# Outpatient Medication System of the Future

- Providers write computerized orders
  - Screened at time written
- Orders go electronically to pharmacy
  - Pharmacist review, counseling for new drugs, on demand
- Simple orders filled using automation
  - ATM-like devices with simple fills
- Patient web sites with medication information
  - Can track progress, report problems
  - Option to use home dispensing devices that record when medications taking

# The Goal

- The best systems will not replace people with information technology, but rather create more time for people to spend on complex decisions by reducing menial tasks.

I'M WORRIED  
THAT HEALTH CARE  
HAS BECOME TOO  
IMPERSONAL, DOC.

NONSENSE...  
JUST RELAX  
AND LIE BACK  
ON THE BAR  
CODE SCANNER.

